

**CLAIMS**

1. A vacuum pump comprising a first pumping section, a second pumping section downstream from the first pumping section, a third pumping section downstream from the second pumping section, a first pump inlet through which fluid can enter the pump and pass through each of the pumping sections towards a pump outlet, and a second pump inlet through which fluid can enter the pump and pass through only the second and the third pumping sections towards the outlet, wherein the third pumping section comprises a helical groove formed in a stator thereof, and at least one of the first and second pumping sections comprises a helical groove formed in a rotor thereof.
2. A pump according to Claim 1, wherein the depth of the helical groove on the rotor varies from the inlet side thereof to the outlet side thereof.
3. A pump according to Claim 1 or Claim 2, wherein the depth of the helical groove on the rotor decreases from the inlet side thereof to the outlet side thereof.
4. A pump according to any preceding claim, wherein the inclination of the helical groove on the rotor varies from the inlet side thereof to the outlet side thereof.
5. A pump according to any preceding claim, wherein the inclination of the helical groove on the rotor decreases from the inlet side thereof to the outlet side thereof.

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6. A pump according to any preceding claim, wherein the depth of the groove at the inlet side of the rotor is greater than the depth of the groove at the inlet side of the stator.
- 5 7. A pump according to any preceding claim, wherein said one of the first and second pumping sections comprises at least one turbo-molecular stage downstream from said rotor.
8. A pump according to any preceding claim, wherein the second  
10 pumping section comprises said rotor.
9. A pump according to Claim 8, wherein the first pumping section comprises at least one turbo-molecular stage.
- 15 10. A pump according to Claim 9, wherein the turbo-molecular stage of the first pumping section is arranged such that, in use, molecules of fluid entering the helical groove on the rotor are emitted from the surface of a stator thereof.
- 20 11. A pump according to Claim 9 or Claim 10, wherein the first pumping section comprises at least three turbo-molecular stages.
12. A pump according to any preceding claim, wherein both the first and second pumping sections are axially displaced relative to the first and  
25 second inlets.
13. A pump according to any preceding claim, wherein one of the first and second inlets extends at least partially around the rotor.
- 30 14. A vacuum pump comprising a first pumping section and, downstream therefrom, a second pumping section, a first pump inlet through which fluid can enter the pump and pass through both the first

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pumping section and the second pumping section towards a pump outlet, and a second pump inlet through which fluid can enter the pump and pass through, of said sections, only the second pumping section towards the outlet, wherein one of the first and second  
5 pumping sections comprises an externally threaded rotor and one of the first and second pump inlets extends at least partially about the externally threaded rotor.

15. A pump according to Claim 14, wherein the externally threaded rotor  
10 comprises a helical groove.

16. A pump according to Claim 15, wherein the depth of the helical  
groove varies from the inlet side thereof to the outlet side thereof.

15 17. A pump according to Claim 15 or Claim 16, wherein the depth of the  
helical groove decreases from the inlet side thereof to the outlet side  
thereof.

18. A pump according to any of Claims 15 to 17, wherein the inclination  
20 of the groove varies from the inlet side thereof to the outlet side  
thereof.

19. A pump according to any of Claims 15 to 18, wherein the inclination  
of the groove decreases from the inlet side thereof to the outlet side  
25 thereof.

20. A pump according to any of Claims 15 to 19, wherein said one of the  
first and second pumping sections comprises at least one turbo-  
molecular stage downstream from the externally threaded rotor.

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21. A pump according to any of Claims 15 to 20, wherein the second pumping section comprises said externally threaded rotor, the second inlet extending at least partially around the rotor.

5 22. A pump according to Claim 21, wherein the first pumping section comprises at least one turbo-molecular stage.

23. A pump according to Claim 21 or Claim 22, wherein the first pumping section comprises at least three turbo-molecular stages.

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24. A pump according to Claim 22 or Claim 23, wherein the turbo-molecular stage is arranged such that, in use, molecules of fluid entering the external thread therefrom are emitted from the surface of a stator thereof.

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25. A pump according to any of Claims 15 to 24, comprising at least one additional pumping section downstream from the first and second pumping sections for receiving fluid therefrom and outputting fluid towards the outlet.

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26. A pump according to Claim 25, wherein said at least one additional pumping section comprises a molecular drag stage.

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27. A differentially pumped vacuum system comprising two chambers and a pump according to any preceding claim for evacuating each of the chambers.

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28. A system according to Claim 27, wherein one of the pumping sections arranged to pump fluid from a chamber in which a pressure of above  $10^{-3}$  mbar is to be generated comprises an externally threaded rotor.

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29. A system according to Claim 27 or Claim 28, wherein at least one of the pumping stages arranged to pump fluid from a chamber in which a pressure of above  $5 \times 10^{-3}$  mbar is to be generated comprises an externally threaded rotor.